

Volume 8

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Number 10

# Lubrication

A Technical Publication Devoted to  
the Selection and Use of Lubricants

## THIS ISSUE

Lubrication of  
Flour Milling Machinery

Lubrication of Firearms



PUBLISHED MONTHLY BY  
**THE TEXAS COMPANY, U.S.A.**  
TEXACO PETROLEUM PRODUCTS

# TEXACO Lubricants for Flour Mills

**B**ELOW we have formulated some recommendations for the lubrication of various kinds of flour mill machinery. We have taken cognizance of the fact that the flour mill operator desires to get along with as few grades of oil as possible, and so we have grouped the machinery and shaped our recommendations accordingly:

## ROLLER MILLS (Relatively Heavy Service)

Fixed Collar Bearings.....	TEXACO ALTAIR OIL
Ring Oiled Bearings.....	TEXACO ALEPH OIL
Ball Bearings.....	TEXACO { PETROLATUM No. 1 GREASE } as temperature No. 00 GREASE may warrant

## MAIN LINE SHAFT And Other Equipment

Ring or Chain Oiled.....	TEXACO ALEPH OIL
Waste Pad, Hand Oiled.....	TEXACO ALTAIR OIL
Grease Cups.....	TEXACO No. 3 GREASE

## GEARING AND DRIVING CHAINS TEXACO Crater Compound

## LIGHT SERVICE

CLEANING SCREENS		Waste Pad & Hand Oiled Bearings	TEXACO ALEPH OIL OR TEXACO NABOB OIL
SCOURERS		Grease Cups	TEXACO No. 3 CUP GREASE
SIFTERS		Ring Oiled Bearings	TEXACO ALEPH OIL OR TEXACO NABOB OIL
PURIFIERS			
REELS			
FLOUR DRESSERS			

**NOTE:** In the majority of cases the above recommendations will provide completely successful and economical lubrication. There will be one or two instances where peculiar operating conditions or unusual construction will require some special attention.

If any of your equipment comes under these headings, write us about it, describing the machine, giving the name of the manufacturer, size of bearing, speed, pres-

sure, etc., and we can immediately supply you with a TEXACO Lubricant exactly suited to the purpose.

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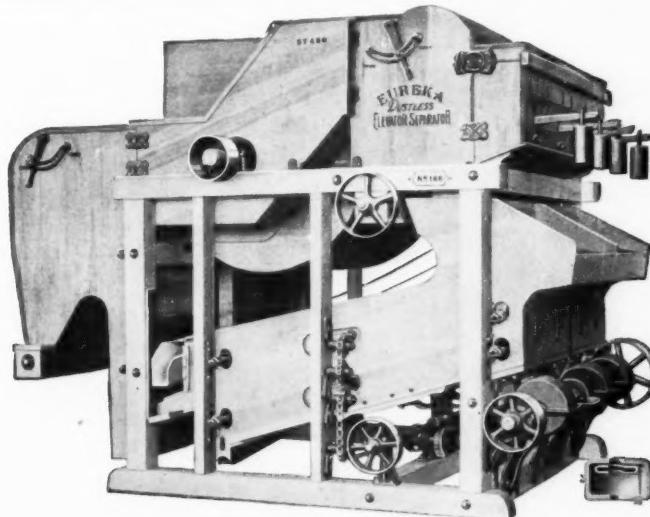
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*Courtesy of S. Howes Co., Inc.*

Fig. 1.—Type of Counterbalanced Twin Shoe Elevator Separator with Automatic Sieve Cleaners under both the main and seed screens, and disc oiling eccentrics. In this machine the grain is treated by three screens and two aspirators.

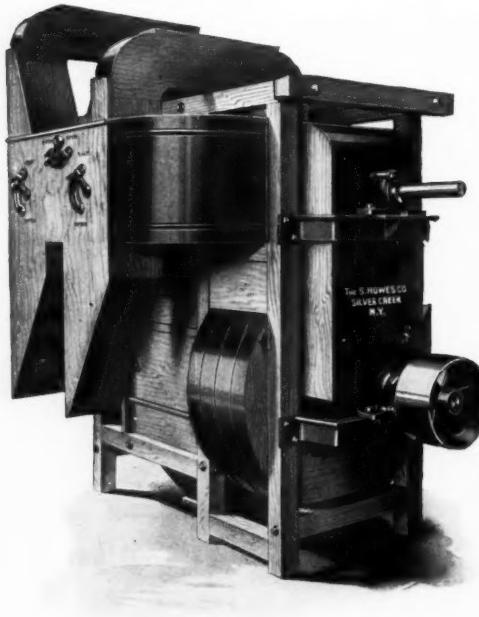
## Lubrication of Flour Milling Machinery

ALTHOUGH the milling of grain is an old art, flour milling as an industry is identified only with the later centuries. In historic times the grinding of the grain, and preparation of the meal or flour, was incidental to and a part of the process of making bread. This was true in the period of the large public bakeries of Rome, and for centuries afterward. The seemingly complex flour mill of today is merely a mechanical elaboration of the simple principle used by man of the stone age. The application of advanced mechanics, and the development of engineering genius has resulted in the assortment and combination of machinery which goes to make the modern flour mill. The object which was sought by prehistoric man in pounding the grain with round

stones in other hollowed, bowl-shaped stones, is the same as that of the present flour milling process, which, of course, more nearly attains perfection in that accomplishment.

A grain of wheat (and the milling of wheat is by far of the most significant importance as compared with the other grains) consists of an outer husk or covering, an embryo or germ, and a central mass of farinaceous material. The outer husk consists of several layers of ligneous tissue, hard in texture, and closely adhering to the seed. In milling this is detached in scales and forms the chief portion of the bran. The inner portion of the envelope is softer and is rich in salts and fats. In the sifting, or dressing, of the flour this usually goes with the coarser particles, or is mixed

with the bran. The substance toward the center of the grain, making the principle part of the flour, is whiter and also more friable; thus it is that the finest flour is also the whitest. (It is because of this fact, that bleaching methods are sometimes employed to improve the color of dark flours.)



*Courtesy of S. Howes Co., Inc.*

Fig. 2.—Type of Double Smutter and Scourer. This machine is fitted with Ball Bearings, two rows of balls supporting the load, or, in reality, two bearings in one. In operation this machine scours dirt, smut and other foreign matter from the wheat as it drops onto a shoe and travels over two screens, which separate impurities larger and smaller than the grain.

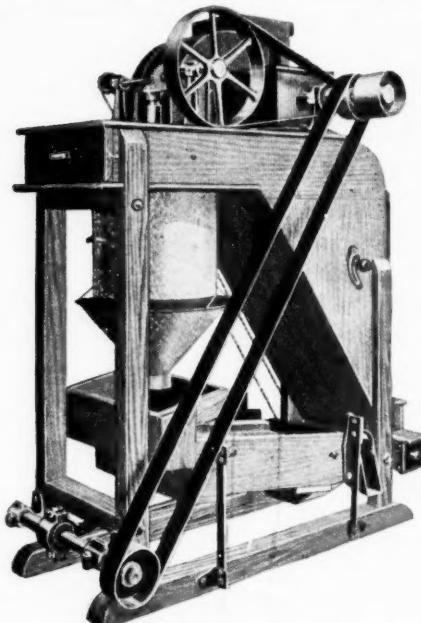
### General Process

The general object of milling is to produce flour of any desired grade, free from impurities, and at reasonable cost. The first process is to grind, without breaking, the granules of the central substance of the grain, and to separate them from the embryo and outer husk. As indicated above, the first "mills" were in reality merely crushers, similar in principle to the mortar and pestil of the chemical laboratory. The next development to this was the substitution of rotary motion for the pounding action; and then came the rotary motion of one flat stone above another flat stationary stone. Power for this motion was at first supplied by a horse which walked in a circle pulling a long lever connected to the top stone. Water power eventually displaced the rudimentary horse

driven mill, and is largely used in the modern mill of today. The above milling process was known as flat milling, and consisted of three parts, which in fact are the three principal divisions in flour milling by modern methods:

- (a) Cleaning and preparation of the wheat.
- (b) Grinding.
- (c) Bolting or dressing of the ground products.

The flat milling process attempted to get the maximum amount of flour in one operation. An improved development of this, known as the Hungarian method, introduced a series of mills, and produced a much finer grade of flour. Modern milling is an extension of the Hungarian scheme. Roller mills of chilled iron replace the old flat stone mills, and the equipment used for the cleaning and preparation of the grain, as well as that used for finishing and dressing the flour, is greatly improved and built according to present day mechanical practice.



*Courtesy of Barnard & Leas Mfg. Co.*

Fig. 3.—Revolving Disc Aspirator. This equipment is extensively used wherever it is desired to remove lighter impurities in various stages of the process. Such a machine can be either single or double and with or without the fan.

Considering the flour mill as a whole, it differs from most other manufacturing plants in that all of the equipment necessary for complete operation is combined to form a single unit, though there may be a number of such complete units in one mill. No part of the process is operated independently of any other,

## LUBRICATION

for the grain, after being fed in at the cleaning screens, passes on through the mill and into the flour bins without stopping en route. There is apparently nothing to be gained by building up the stock of one department to be drawn on as needed by the next step in the process, even were it allowable. On account of operating as a unit, it is natural that all the equipment should be tied together or connected up to the same power source, and operated ostensibly as a single machine of many parts. This unit operation is particularly well adapted to the use of water power, and this power is found to be very generally applied, although steam or electricity are frequently installed as stand-by supply in case of unfavorable water levels.

As stated above, modern milling processes divide the grinding over a series of mills, after cleaning the grain to remove all dirt, smut, and separate foreign seeds. It is then tempered to effect a content of moisture in the proportion found advantageous to the best milling, and fed to the first breaker rolls. In modern practice the break system consists of five distinct operations, each having its own means of separation. In adjusting the breaker rolls the principal object in view is to produce as large a percentage of middlings as possible, with a minimum percentage of flour. There is also the ultimate object of freeing the bran of all adhering flour and at the same time producing a broad bran. The first three breaks produce the middlings from which the patent flour is made, while from the fourth and fifth breaks middlings of a lower quality are obtained, which are used for the second grade of flour. A shear-

ing action is obtained with each pair of breaker rolls due to the corrugations thereon being cut with a slightly longitudinal spiral. This action is augmented by the speed of the fast roll of the pair, it being  $2\frac{1}{2}$  times as rapid as its mate, or the slow roll.

The grinding rolls are smooth, and each series or group is set up closer, so that each grinding step tends to produce a finer product. The

middlings, from each grinding process, are passed to the sifters or bolting machines, where such flour as has been made is separated out, and the tailings, after the impurities have been scalped off, pass to the next mill for further grinding. The tailings from the last mill are used in coarse flour or stock feed which is generally prepared as a by-product.

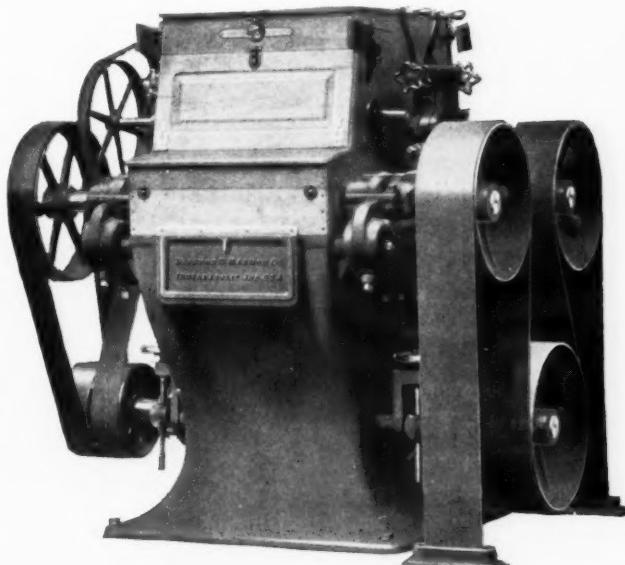
The flour is finally dressed or bolted, on reels

covered with silk of definite mesh, to separate it into the different grades. As has been stated, the finest flour is the whitest, and considered the best. Good flour also is of even texture, so the very finest pulverizations are not desired in the finished products. This part is removed by dust collectors, and is used in making prepared stock feeds.

## Cleaning Machinery

Before the grain is ready for the grinding mill it is first passed over cleaning screens and then sent to scourers and brush polishers, and to tempering bins.

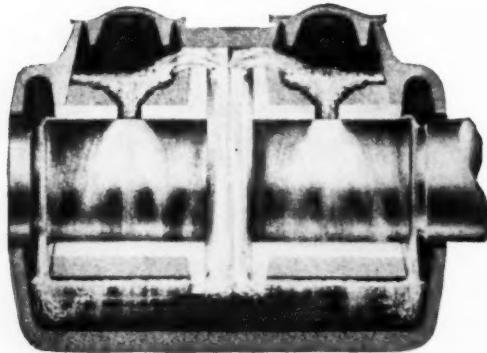
Cleaning screens or separators are of different types; the shaking screen is probably the more common. In this type of machine the grain passes over flat screens mounted at an angle



*Courtesy of Nordyke & Marmon Co.*

Fig. 4.—Double Roller Mill showing driving belt and arrangement for driving high speed rolls. Lubrication of such machinery is a problem, due to high speeds and excessive pressures developed on the roll bearings. Ring oilers, ball or fixed collar type bearings may be installed as considered requisite to meet operating conditions.

so that as the machine is vibrated the grain naturally takes a sliding course down the screen. The mesh is such as to permit the passage of the wheat grains alone, excluding foreign grains, straws, etc. The drive of such machines is by belt from shafting. The vibratory motion of the screens is effected by eccentrics, operated



*Courtesy of The Wolf Company*

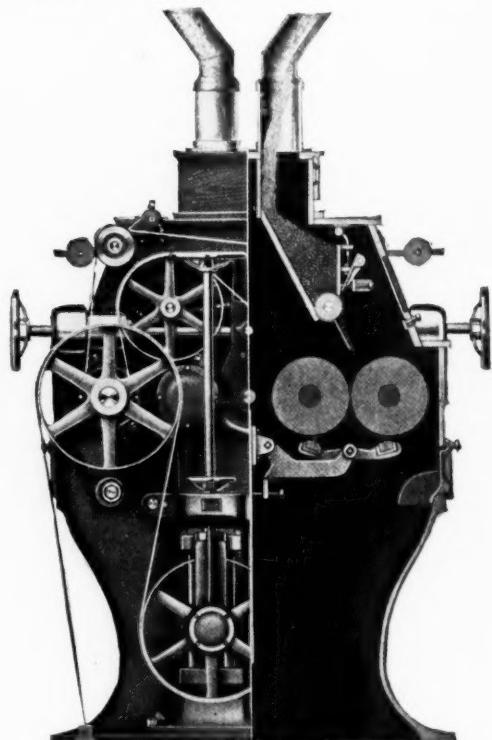
Fig. 5.—Illustration of the fixed Collar Oiler Bearings as used on 6-inch and 7-inch mills, and on feed mills. It can be easily seen that this type of bearing is a veritable oil gusher. Every journal literally rotates in a reservoir of clean oil.

at speeds up to 550 r.p.m., the shock of reversal being partly taken up by suitable springs. This service is somewhat severe, because of the imperfectly cushioned reversing motion. Also, the general construction of the equipment is of wood, which after a little use loses some of its rigidity, and there is a chance for the bearings and eccentrics to run warm, due largely to strains induced by this lack of rigidity. As a result the machines appear to "pound." The lubricant required is, and should be, a heavy grade of engine oil, of sufficient body to supply a protecting film.

In the scourers and brush polishers, in order to clean the particles very thoroughly, the grain is subjected first, to a pneumatic separation to remove superficial foreign matter, and then to a severe scrubbing or brushing action to remove crease dirt. The machines may be vertical or horizontal. In either type the central shaft with scouring cylinder or scrubbing brushes is the moving element. Speed of operation is as high as 700 r.p.m. in machines of small capacity, and as low as 350 r.p.m. in the larger sizes. The lubrication demands are very readily satisfied by a good grease, or engine oil, depending on the design. Bearings may be

constructed for chain oiling, or fitted with ball bearings.

The tempering bins involve no mechanical features introducing lubrication problems. The grain is heated and the moisture is introduced into the grain in passing through suitable conveyors, which provide for thorough mixture. The moisture content, and temperature of the grain has been found to be a vital factor in effecting good grinding, and is very carefully checked and regulated.



*Courtesy of The Wolf Company*

Fig. 6.—Side Sectional View showing a typical Ball Bearing Double Roller Mill with Automatic Roll Feeder, Automatic Adjustable Roll Scrapers and Spring Grinding.

### Grinding Machinery

The grinding and bolting parts of the process are very intimately inter-connected, as the discharge from each set of rolls passes to purifiers or reels. The grinding rolls are very accurately made and sensitively adjusted, and constitute the most important part of the mill from a lubrication standpoint. It is essential to good grinding that the rolls shall be exactly parallel so that the grain in passing through them will encounter the same clearance along the entire length of the rolls. It is interesting to note

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that because of heat generated by the grinding action of the mill and at the bearings, it is necessary in grinding the surfaces to taper the rolls about an inch back from the ends a few thousandths in diameter in order to compensate for expansion and prevent the rolls from coming in contact on the ends when grinding.

The drive of each set of rolls is by belt from a main line shaft. Inasmuch as one roll travels faster than another, in ratio varying from 1 to  $2\frac{1}{2}$ , to 1 to  $1\frac{1}{4}$ , a differential speed is provided through belts from the jack shaft on the mill. The speed ratios desired determine the size of the pulleys to be used. In designing, the machines are generally built as double units, or as two pairs of rolls in one frame mounting, and actuated from the same jack shaft.

In some of the newer machines the rolls are mounted on ring oiled bearings, or, in a few cases, on ball bearings. In the older machines it is the custom to use the fixed collar type of bearings, the collar on the shaft or roll neck dipping into an oil reservoir to carry up oil for distribution to the bearing. This fixed collar also tends to restrict the lateral motion of the roll. Coil springs serve to keep the rolls from contact, and also to furnish relief should any hard foreign substance be fed in with the grain. One of the rolls is fixed in its position, except provision is made for vertical adjustment to effect paralleling; the other roll is adjustable through the springs mentioned, to provide even clearance and pressures as desired. The pressures on the roll bearings approach 4,000 lbs.

Therefore the lubrication of the mill bearings is usually a most exacting problem. Also the mills run at comparatively high speed of 500 r.p.m. or more. As a result the oil which will perform suitable service on the bearings must be heavy enough to supply a film to withstand the pressure imposed without rupture, and at the same time one which will not introduce too much fluid friction under the speeds

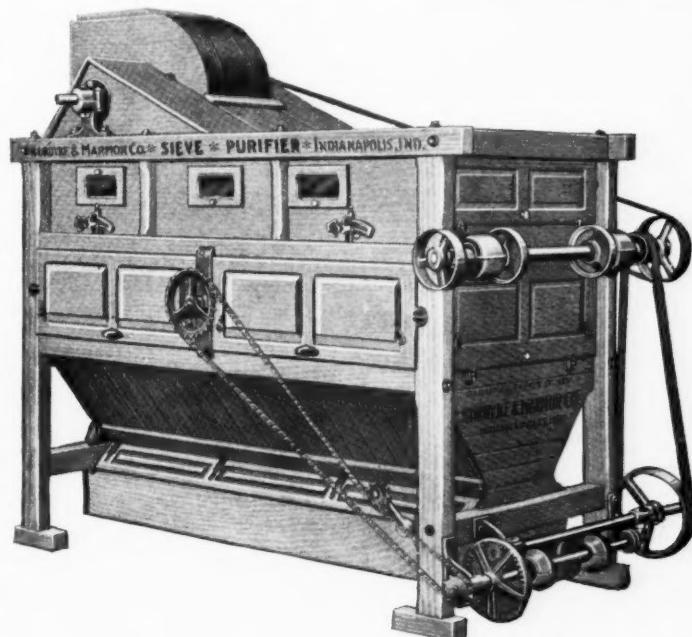
at which the rolls are operated, but will feed readily between the journal and bearing. The grinding of the wheat generates heat which is radiated partially by ventilating the rolls, although some of the heat is conducted to the bearings and tends to increase the normal temperature condition at those points.

The feeding devices for the mills vary in

design, but are all mechanically operated and driven by small belts from one of the shafts on the mill. This is light service and the bearings are often provided with small compression grease cups, or designed for hand lubrication.

### Sifting and Bolting Machinery

The discharge from the breaking rolls is delivered to sifters, wherein such middlings and flour as may have been produced in the first grinding process are separated and the tailings therefrom are passed to the next finer set of rolls. The sifters may be of different types, but the usual form is a huge box-like arrangement suspended from ceiling beams or upper supports on long wood or steel rods, termed



Courtesy of Nordyke & Marmon Co.

Fig. 7.—Standard Sieve Purifier. This Machine is used to purify the discharge from secondary breaking rolls, and render the various middlings suitable for finished grinding. Flour and middlings are sifted out by means of vibrating screens, driven by eccentrics.

reeds of from  $\frac{3}{4}$ " to  $\frac{7}{8}$ " in diameter. Two to four of these box-like sifters are usually grouped around a central vertical shaft to which they are connected, and from which they receive a vibratory motion through eccentrics. The speed of this central shaft is in the neighborhood of 180 r.p.m. It is mounted on a step bearing which, however, carries only the weight of the shaft and pulleys. In general an engine oil is used for lubrication of the step bearing; but because of the inaccessibility and arrangement, remotely located grease cups have been found more applicable to the vertical guide bearings.

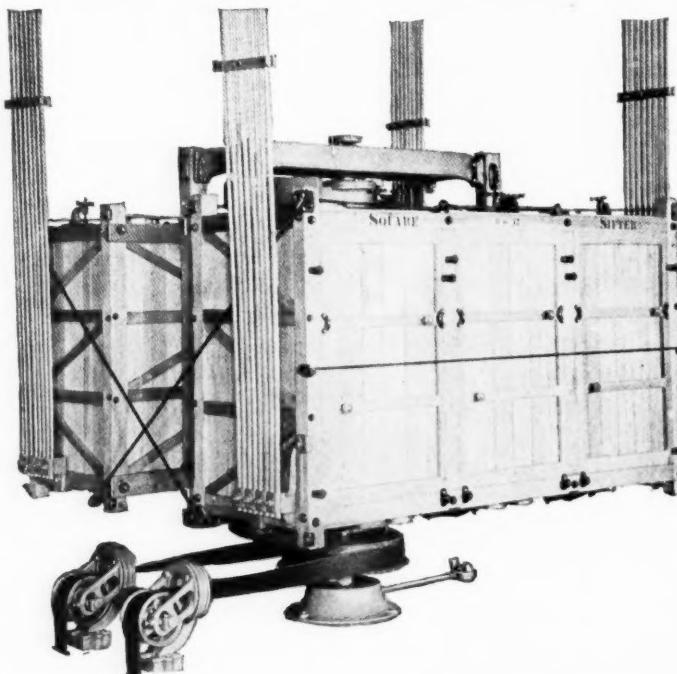
The discharge from subsequent breaking rolls, passes to purifiers built somewhat on the principle of the cleaning screens, except that much finer mesh material is used. This separates the various middlings, so that they may be delivered to suitable rolls for finishing grinding. These screens are mounted horizontally, slightly pitched, so that the material being fed at one end will gradually work down to the other over this vibrated screen; at the same time a suction is created above to carry off the bran which is lighter and of greater surface area. The middlings are sifted through, and the tailings are returned to mills for further grinding. The action of the screens is effected through eccentrics connected to a small shaft on the end of the machine, which is belt driven. The loads, and speed of about 575 r.p.m. on the eccentric shaft, are not considered hard service and a good grade of engine oil will handle the

condition easily. While somewhat similar to the separators used to clean the grain at the start of the process, the machines are less bulky, parts are lighter and the service is less severe.

The bolters and dressers which are used to sift the discharge from the finishing rolls are machines which really present very light service. The flour dresser is in reality a cylinder covered with fine mesh silk or bolting cloth,

and mounted at a slight angle. The product from the mill is delivered at one end and travels slowly down to the lower end as the cylinder revolves, the flour being sifted through. The tailings may go into coarser flours or meals, or they may be passed to rolls for further grinding.

Under the classification of flour dressers may be included the centrifugal or differ-



*Courtesy of Nordyke & Marmon Co.*

Fig. 8.—Typical Flour Mill Sifter arranged for belt drive. Two to four of these sifters are usually grouped around a central vertical shaft to which they are connected and from which they receive a vibratory motion through eccentrics.

ential machines. They are generally used to sift the product from the finishing rolls. In these reels, there is, in addition to the revolving screen, a set of blades on the inside of the cylinder which is operated at a different speed, so that the material within the screen is thrown up or beaten against the bolting cloth so as to aid in the sifting process. These machines run at speeds in the neighborhood of 100 r.p.m., and are mounted on small plain bearings, lubricated from an oil can periodically. The machines include revolving brushes to dust off the flour which sifts through the cloth, and small screw conveyors at the base to carry off the finished product.

Suction fans exhausting into dust collectors

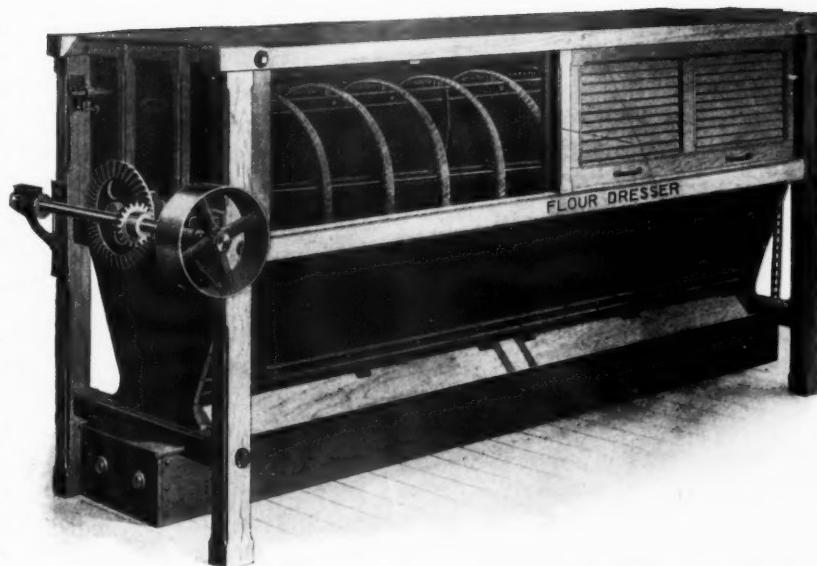
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remove the very finely pulverized material, which is used for the manufacture of meal, as it is too fine to be put into the best grades of flour.

### Bran Machinery

One by-product in the manufacture of flour is bran. This is passed through bran dusters which remove any adhering flour. This machine is usually of upright design, and contains a vertical cylinder of cloth on a frame,

which revolves slowly inside the housing. The bran is spouted in at the top, and by means of a revolving disk is distributed over this cloth (or case). The brushes are attached to the central spindle which is revolved at a speed of 300 to 450 r.p.m. The brushes dust off the particles of bran, and sweeps at the bottom discharge the flour through the opening provided. The bran is also discharged through a similar opening. The lower head of the case

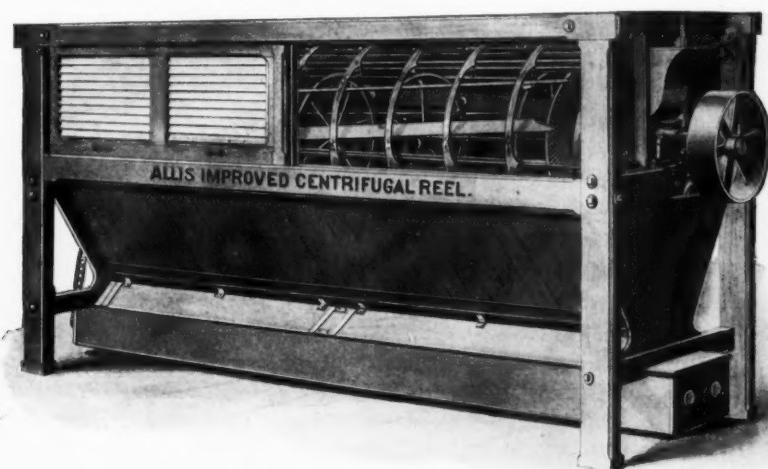


*Courtesy of Allis-Chalmers Mfg. Co.*

Fig. 9.—Flour Dresser showing interior construction. This machine is used to sift the roll products as desired. Essentially it consists of a cylinder covered with fine mesh silk or bolting cloth through which the flour is sifted as the former revolves. This cloth is cleaned by a suitable revolving brush.

revolves in a babbitted, oil-retaining bearing. The spindle which carries the brushes is carried on a step bearing at the bottom, and is usually equipped with a self-oiling bearing at the top. The driving belt is passed over a pulley on the spindle shaft just above its step bearing outside the housing; and by means of encased gears or a small short-centered belt on the top, slower motion is imparted to the case. The lubrication problem is classifiable as light duty service, and easily handled by an engine oil of 200" Saybolt viscosity.

The bran may be marketed as delivered from the dusters, or it may be passed through pulverizers and used in the manufacture of stock feed. For certain uses there are requirements that the bran shall be ground very fine; and for this reason



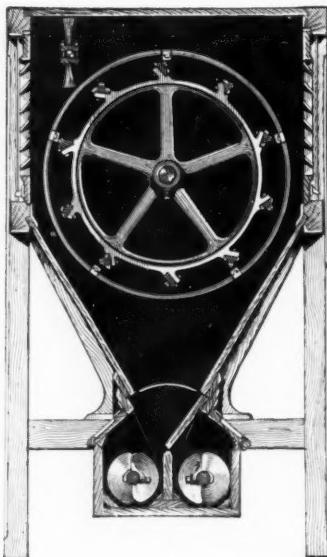
*Courtesy of Allis-Chalmers Mfg. Co.*

Fig. 10.—Typical centrifugal reel. This machine is used to sift the product from the finishing rolls.

the pulverizers used are found to be of very high speed types.

### Miscellaneous Machinery

Drafts and air currents used in ventilating the rolls, and in separating bran in the purifiers, are produced by centrifugal blower type fans. In general, these are operated by belt from the



*Courtesy of Allis-Chalmers Mfg. Co.*

Fig. 11.—Sectional View of Centrifugal Reel. Interior construction is clearly shown.

mill shafting, though in some cases individual motor drive is installed. The waste-pad and the ring-oiled bearings are the prevailing types; engine oil of about 200° viscosity is the suitable lubricant for the service.

The connecting links between the various machines of the flour mill, which form the whole assemblage into a single unit, are the conveyors, elevators, and spouts. The material is carried via such equipment from machine to machine as it progresses through the process. The screw conveyor is the usual type for horizontal movements. The transfer between floors is by bucket type continuous belt elevators.

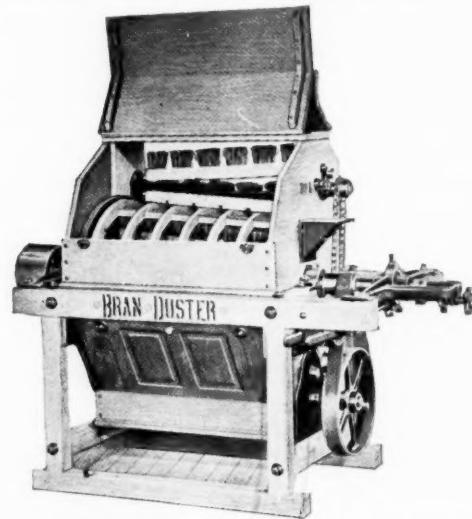
The employees' automatic belt elevator is an arrangement peculiar to flour mills. It is a continuous belt with small platforms attached thereto, which travels at a belt speed of approximately 75 feet per minute. It extends usually from the basement to the top floor, and is used by the employees to go from floor to floor. Like all the other elevators in the

mill, it is belted up to the driving shafting, and operates continuously with the mill. A worm gear reduction is used to obtain the desired speed.

### Bagging Machinery

The finished flour is delivered from the flour dressers into bins or hoppers, from which it is spouted to the bag filling machines. The bagging department is separate from the milling process, and is not a part of the milling unit. There are advantages of operating these machines independently, in that 24 hours' operation need not be considered where shipments do not require it, and bagging can be done while the mill may be shut down.

The bagging machines are generally driven by belt from a small line shaft, operated by motors. The problem of lubrication does not differ from the usual small shop and light machine service, except that the bearings should be kept free from accumulation of flour dust which might choke off the supply of oil.



*Courtesy of Nordyke-Marmon Co.*

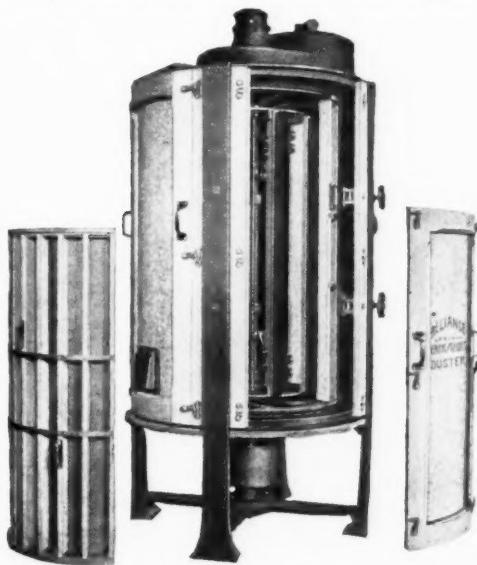
Fig. 12.—Horizontal Bran Duster. In this machine the bran follows an inclined path in its course through the machine. The purpose of the duster is to remove adhering flour from the bran by revolving brushes.

### Grain Elevator

The elevator where the grain is received and stored until ready for use, is another department which is operated separately from the milling unit. Because of convenience, electricity is most generally adopted as the source of power, individual motors being used to operate the elevators and conveying belts.

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which constitute the chief mechanical equipment in the elevator. The elevator unit is the bucket-type, continuous belt design, usually of the larger sizes. The elevator head pulley operates at about 32 r.p.m., regardless of size, so that speed of belt travel is determined by pulley



*Courtesy of Allis-Chalmers Mfg. Co.*

Fig. 13.—Bran and Shorts Duster. In this particular machine the dusting cylinder has a hardwood frame, with a special grade of non-rusting wire cloth inside. Revolving brushes are fitted with an adjusting device (externally operated) by means of which the brushing action can be made more or less severe. The brush spindle revolves in a step bearing in the base, the top usually being carried by a self-oiling bearing.

diameter, and may reach 600 feet per minute. The loads on the bearings of the head are considerable, as they support the total weight of the belt and loaded buckets. Ring-oiled bearing mountings are usual, and oil of about 200° Saybolt viscosity is found suitable.

The troughing belt conveyors are driven also by motors, usually through belts. The end pulleys are generally mounted on ring-oiled bearings, and the same lubricant as used on the elevator head is applicable. Here the service is not as severe since the bearings are not required to support such great weight. The troughing rolls and return rolls are all lubricated through compression grease cups.

### Lubrication

As the roller mills involve the most exacting service from the lubrication standpoint in general, the oil selected for mill operation is governed by their requirements. It is the usual practice to employ one brand of oil for

all shafting and machines, including the roller mills, throughout the entire plant. This may be due to traditional practice; however, there is introduced the valuable feature of reducing possible confusion and substitution to a minimum. Many of the machines, such as the shaking screens, purifiers, flour dressers, and packing machines could use a lighter grade of engine oil than is required for the roller mills.

The oil for the roller mills must necessarily be of heavier body than is prevalent in the largely



*Courtesy of Barnard & Leas Mfg. Co.*

Fig. 14.—Illustration of a typical Drop-Gear Iron-Front Flour Packer. Details of construction are clearly shown.

used grades of engine oil, and for that reason it is very often found that so-called "gas engine" oils are in use on this service. Inasmuch as other bearings are the plain babbitted types requiring periodical application of oil, there is a valuable asset in using this heavier oil, in

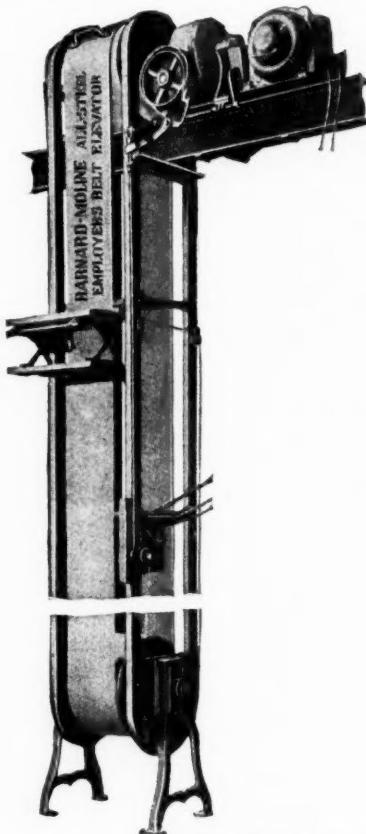
that the film can be expected to remain on the surfaces for longer periods.

As can be readily conceived, there is considerable dust in a flour mill and this dust has two effects. In the plain bearings where the general method is to fill the top of the box with a pad of waste, on which the oil is poured and allowed to filter through, the dust will collect and may prevent the admission of the oil to the bearing. At the same time, the waste will keep the dust from working into the bearings. These bearings must be watched closely to see that there is clear passage for the oil and that they are adequately protected from the dust. The oil and flour dust will form a sort of clot to gum up small passages, and if allowed to get on the grooves of the bearings will so fill them that distribution of the oil would be prevented. It is interesting to note that the very soft flour, as we would judge it to be, is really abrasive in nature. This is proven by the wearing down of the rolls and internal parts of grinding machines and by the destruction of ball and other types of bearings, where the dust has been allowed to enter.

The flour mill operates, in general, on a 24 hour schedule, excepting the elevator and bagging departments as indicated; this is a service which is very exacting. It is to be recalled, too, that a failure at any one point will shut down the entire mill, and completely stop production. Very few men are required as the process is to an extent automatic, but continuity of service is dependent on good maintenance, and careful surveillance over the condition of the equipment is of vital importance. Lubrication enters into the maintenance problem as a most important feature, but rather as a preventative than a remedy. Effective lubrication reduces wear, and prevents hot bearings, thereby aiding to avoid shutdowns, necessitated by repairs. Regularity of applications is accordingly very important, particularly when practically all the bearings are hand lubricated. The usual practice is to assign this duty to one or more employes, whose occupation is to oil all the bearings of shafting and machinery. Certain service which is more severe may get attention as often as once per hour, whereas other light service receives oil only once in 8 hours. Effective and convenient storage facilities are essential

in order to keep the oil free from dust; and clean methods of application, avoiding slopping about of excess amounts of oil, are demanded by the requirements of sanitation.

An interesting feature in the operation of flour mills is that the power required to drive



*Courtesy of Barnard & Leas Mfg. Co.*

Fig. 15.—Motor-Driven Type of an All-Steel Employes' Belt Elevator. The head of driving mechanism is a self-contained unit. Worm and gear equipment for power transmission operate in an oil bath. This machine usually operates continuously and is available for service at any time.

the mill fully loaded (*i.e.*, grinding to capacity) is very little more than that demanded when no grain is passing through. The apparent apathy toward effecting power economies is explainable by the fact that water power is very largely used, and frictional losses do not appear on the cost sheet as prominently as when coal or purchased electric current are the sources of energy. In some mills where power is not a cheap item, roller mills and other machines are ball bearing equipped; the higher initial cost is usually not warranted where power supply is cheap.

Considering the above it again is evident

## L U B R I C A T I O N

that lubrication is an important factor in the economical operation of flour mills. It might be possible to select different lubricants for each machine or mechanical condition, with a view of reducing frictional losses to a minimum. However, this would prove most impractical, and might even show increase in cost due to greater care required in the application of the oils, and wastage of high priced lubricants which might be chosen for some of the services. As already indicated, the policy and practice obtaining is to use one oil throughout the plant; this oil is chosen to meet the most severe conditions, and merely furnishes additional protection at points of lighter service, though perhaps at a sacrifice, by introducing increased fluid friction.

The oil found most generally applicable is

one of about 400 to 500" Saybolt Universal viscosity at 100° F. In some plants a heavy engine oil, or a gas engine oil is purchased, and used as received; some few plants mix light engine oil and cylinder oil to get the desired body. This latter method is very undesirable in that there are introduced uncertainties in the uniformity of mixture from batch to batch, and lack of homogeneity in blending, besides the disadvantageous content of animal compounding usually present in the cylinder oil. Many of the heavy engine oils and gas engine oils are blended products, and if obtained from reputable refiners can be relied on to be uniform and homogeneously blended. A better lubricant, however, is the straight run unblended heavy engine oil.

## Lubrication of Firearms

**W**E have all owned or hoped to own a good gun at some time or other.

Hardly a man lives who has seen the exploits of Buffalo Bill, or read the stirring tales of the Far West in its infancy, who has not cherished a secret desire to emulate them. Such feats require a good gun, and proper care of it in every way. No records were ever made with a mediocre arm, the barrel of which was pitted or rusted. But by no means are records the most essential features that should prompt the owner of a good firearm to take proper care of it. Respect for a high-grade piece of mechanism should be sufficient incentive. Many sportsmen nevertheless unwittingly neglect their firearms not from lack of lubricants and preservatives, but purely because they do not know the proper products to use.

### Choice of the Lubricant

The essential characteristics of a good firearm lubricant are:

1. The viscosity or body should be such that a perfect film of oil will be maintained as a preventative of rusting. Comparatively, such an oil would be of about the same consistency as a light machine lubricant, *i.e.*, 100" Saybolt at 100° F. In firearms the primary function of the lubricant is to prevent rusting, though naturally the action will operate easier and show less deterioration (or wear), the higher the lubricating value of the oil.

2. The pour test should be sufficiently low that the oil will not gum or congeal in extremely cold climates. For this reason the oil should be made from a selected crude stock that will insure the above results. Pour test or (as it is sometimes termed) the cold test should be at least minus 5° F.

3. There should be no trace of acidity whatsoever.

4. The oil should have as little evaporative tendency as possible inasmuch as evaporation will naturally leave the metallic surfaces unprotected against rust.

5. There should be no animal or vegetable compound contained in the lubricant on account of the possibilities of these turning rancid, gumming, or causing the formation of acidic compounds.

### Application of the Lubricant

To a great extent the manner of application of the oil to a firearm and cleanliness of the surface to be treated, are as important as the quality of the lubricant. The cardinal requirement is that the surfaces should be thoroughly cleaned before oiling is attempted. Cleaning of the gun barrel can be effectively done by flushing with boiling water, pouring this in from the breech end to sluice any residue out through the muzzle. Never reverse this process, or residue will run into the mechanism (if attached) and entail additional work in cleaning.

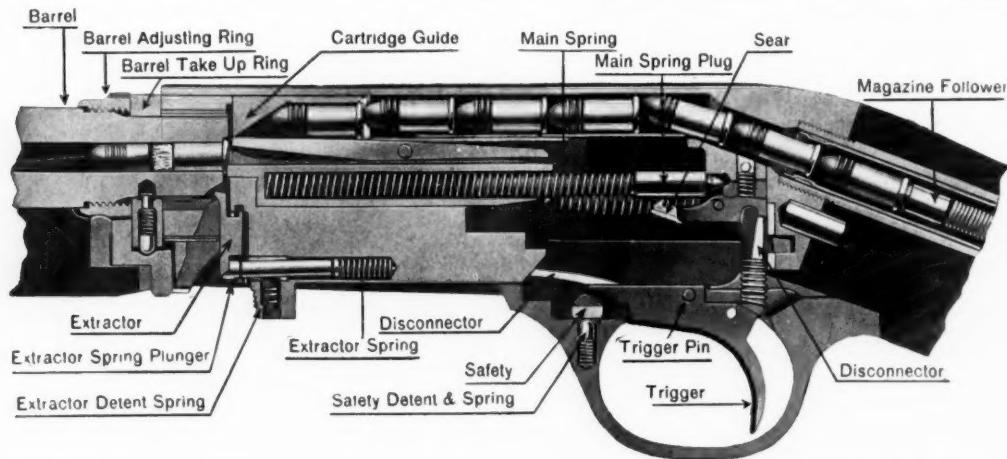
In the absence of hot water, practically the same results can be obtained by using household ammonia on low pressure arms, or 28% ammonia on high power rifles. Due to the fact that ammonia will have a marked tendency to cause rusting within the gun barrel, it must be very thoroughly and quickly cleaned out after usage.

In final oiling of the barrel, always work from the breech end in order to protect the muzzle as much as possible. In using the cleaning rod, the oiling pad should be dampened with oil, and passed backwards and forwards with a twisting motion. It is well to turn it sharply

peratures. All metallic surfaces should be thoroughly greased in such cases. When it is desired to remove this grease use gasoline or benzine. Either will effectively cut the grease without damage to the mechanism, and render the arm fit for oiling as explained heretofore. It is not generally advisable to put a gun into action when so greased, due to subsequent difficulties in cleaning.

### Conclusion

Having observed the above reminders, it will only remain for the sportsman to remember



*Courtesy of Remington Arms Co., Inc.*

Fig. 1.—Illustration of a modern auto-loading rifle showing in detail the intricate construction of breech mechanism. The necessity for the treatment of such parts with a suitable preservative which will serve not only as a rust or corrosive preventative but also as a lubricant, can be appreciated.

at the breech on each forward motion to prevent fouling at the latter.

Cleaning of the action can be effectively done by rubbing the parts with an oily cloth, well soaked with the lubricant. In excessively cold climates the Remington Arms Company recommends cleaning such parts with gasoline and dusting with powdered graphite. This is due to the fact that the usual gun oils will not stand temperatures around minus 40° to minus 60° F. without a certain amount of solidification which may interfere with free movement of the action.

When a firearm is to be put away in storage or expected to be out of service for any length of time, in localities where dampness may be at all excessive, it is better to use a high-grade neutral grease of sufficient body to stay where it is applied and not flow under normal tem-

that if he properly cleans and oils his firearms promptly after shooting is finished, and makes sure the oil and grease are suitable for the purpose, he will rarely have cause to complain of rust, pitting or faulty action. The primary features of a good firearm are accuracy and dependability. These can only be maintained by proper cleaning and judicious application of the highest grade lubricating and preservative oils. Finally it should be remembered that in order to insure the gun against possible damage, the general operation of cleaning should always be repeated the next day, if the gun is to be laid away for any length of time. This is due to the chemical action of any residue that may have remained in the barrel sweating out in the pores of the steel. As a result it is never safe to lay a gun away with but a single cleaning, no matter how thorough it has been.



# TEXACO GUN OIL IN NO MAN'S LAND

(By EX SERGEANT M———)

**I**T was just at "stand to," or "zero hour" in the early morning of Aug. 1, 1918 that I first saw Texaco Gun Oil in "no man's land."

"And I saw a Yankee dough-boy take a long chance to get it.

"Gun Oil in the first line trenches is a rare luxury—as precious as smokes. But it's needed. Hours on a parapet in drizzling rain in knee deep mud is, by no means, good for a rifle. It's bound to rust. But, as any soldier who has been 'up there' knows, a good gun oil will prevent rust.

"Anyway, to get back to my story:

"In the half light I saw what I knew to be a one pint can of Texaco Gun Oil about five yards outside of our furthest wire. Somebody had thrown it out there where all the trench garbage goes.

"While I was looking at it I saw a dirty hand on the end of an olive drab arm reach, grab it, conceal it. Then hand, arm and all disappeared into the shell hole that hid the figure of the dough-boy.

"A few moments later the adventurous dough-boy crawled back through our wires grinning. I hailed him and asked him if he knew he had risked a General Court Martial by leaving his post. He said he did, but he guessed he could get away with it. His was a two-man post. His buddy had kept a lookout. He seemed to be entirely oblivious of the real danger—the German snipers.

"I said to him, 'The can is empty, anyhow,' hoping it wasn't.

"He said he figured on that, 'but there's always a few drops left at the bottom of every empty oil can.'

"And he triumphantly proved it by patiently draining out six or seven drops of oil on the corner of a dirty handkerchief. With a grin he opened up the breech and immediately gave the vital parts of his rifle a dab of Texaco Gun Oil.

\* \* \* \* \*

"Later, when it was all over, this man and the rest of us had many reminders of his escapade. During the months of drilling, while waiting for the ship to take us home, our Division and many other Divisions, used plenty of Texaco Gun Oil—every day. We all used it for the bore and the breech before going on the range.

"That little case of Texaco Gun Oil, which fits in the butt of the rifle, was relied on to keep our shooting up in case Jerry decided to get busy again. We used it after firing to free the bore of that pest,—burnt powder.

"For myself, I am sure that Texaco Gun Oil saved me from many a tour of extra detail, or 'K.P.,' for on a Saturday morning's inspection a speck of dirt on a screw head was often sufficient for the 'Looie' to say 'Dirty gun!'

"But the man who took a little time—very little time over his rifle and some Texaco Gun Oil, could always be counted on to pass inspection.

"I know that Texaco Gun Oil will keep all fire arms in shape—all types of pistols and rifles. And while my bird gun doesn't have to come under the scrutiny of a Saturday's inspection, I know I can rely on it in all weather, because I am never out of Texaco Gun Oil."

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**P**ERHAPS our young friend is a little over enthusiastic, but as so many of the boys who have been "over there" have told us how well they rated Texaco Gun Oil,—we'll let it stand.

# Go! and you're away

You step on the accelerator, a lively stream of vaporized Texaco Gasoline shoots into the cylinders, and you're away!

The car fairly leaps forward because of the quick pick-up of the volatile gas.

The volatile quality of Texaco Gasoline enables the complicated mechanism of pistons, valves, levers, rods and cams to function with the maximum power as the engineer planned:—and to do it immediately at your touch.

Make your next fill at a Texaco pump, anywhere. You will buy a new enjoyment of your car, a livelier, more responsive, more powerful car, that will obey you instantly and wholly and carry you considerably farther for each gallon used.

THE TEXAS COMPANY, U. S. A.

*Texaco Petroleum Products*



# TEXACO GASOLINE      MOTOR OILS